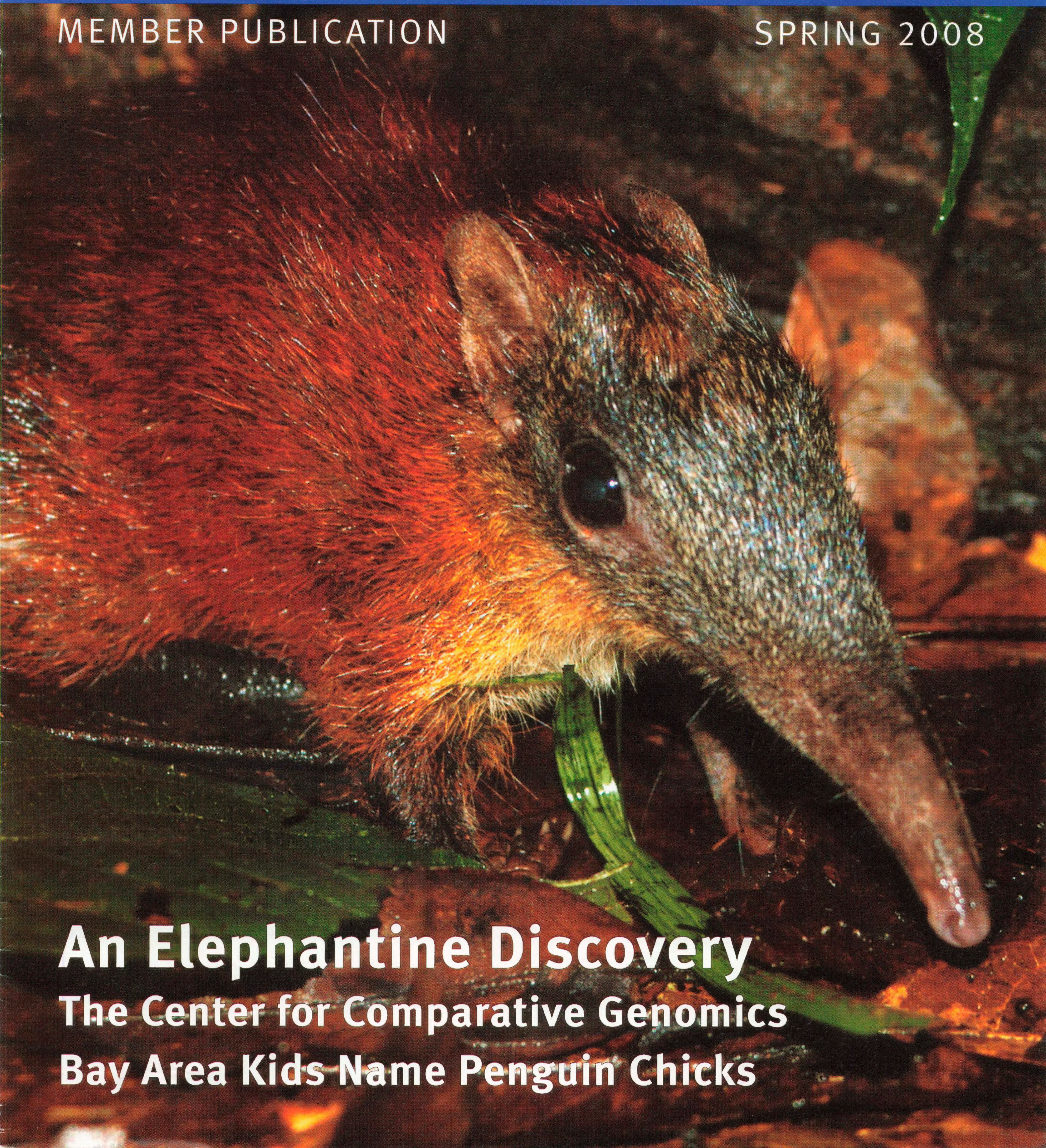
CALIFORNIA ACADEMY OF SCIENCES

MEMBER PUBLICATION SPRING 2008



An Elephantine Discovery

The Center for Comparative Genomics

Bay Area Kids Name Penguin Chicks

MESSAGE TO MEMBERS

Ever since 1853, when the Academy's founders initiated the first comprehensive survey of California's rich biodiversity, the Academy has been at the leading edge of scientific exploration. September 27th, the day we open the Academy's new building in Golden Gate Park, will be the start of a new chapter in our story of innovation and discovery.

In addition to its "library of life" in the form of more than 20 million scientific specimens, the new Academy will house state-of-the-art laboratories that include a new Center for Comparative Genomics (see page 10 to learn more). It will also continue to support expeditions to far corners of the world. Academy Research Associate Galen Rathbun recently returned from one such expedition to the mountains of Tanzania, where he discovered a new species of elephant-shrew, a charismatic little creature whose closest living relatives include elephants and sea cows. By documenting and describing new species, Academy scientists not only help to create a more accurate map of life on Earth, they also provide data that can inform critical conservation decisions.

The Academy's Great Migration back to Golden Gate Park is now well underway. Nearly two million pressed and dried plants have been packed into cardboard boxes, sent to a giant freezer for a pest-prevention layover, and then unloaded into 1,234 storage cabinets inside the new building. More than 100,000 bird specimens (including a collection of Darwin's famous finches), over 10,000 nests and eggs, and about 30,000 mammal specimens have also made the move. Butterflies, beetles, and bees are among the next members of the migration, as the entomology department prepares to start moving its 14.5 million specimens.

Meanwhile, aquarium tanks are being filled with water, live animals are being introduced to their new exhibits, and the planetarium screen is being installed in the new Morrison dome. Over the course of the spring, the Philippine Coral Reef will be filled with fish, corals, sharks, and sea turtles. The Swamp will once again become home to American alligators and alligator snapping turtles. Bats and birds will flutter into the rainforest dome, and the penguins will march into African Hall.

Thank you for supporting the Academy through this remarkable rebirth. The new California Academy of Sciences is literally coming to life, becoming more vibrant each day. We look forward to sharing it with you during our special member preview days in September.

Greg Farrington, Executive Director

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A DISCOVERY OF ELEPHANTINE PROPORTIONS

Academy scientist Galen Rathbun recently discovered a new species in the forests of Tanzania. Despite appearances, its closest living relatives include elephants and sea cows.

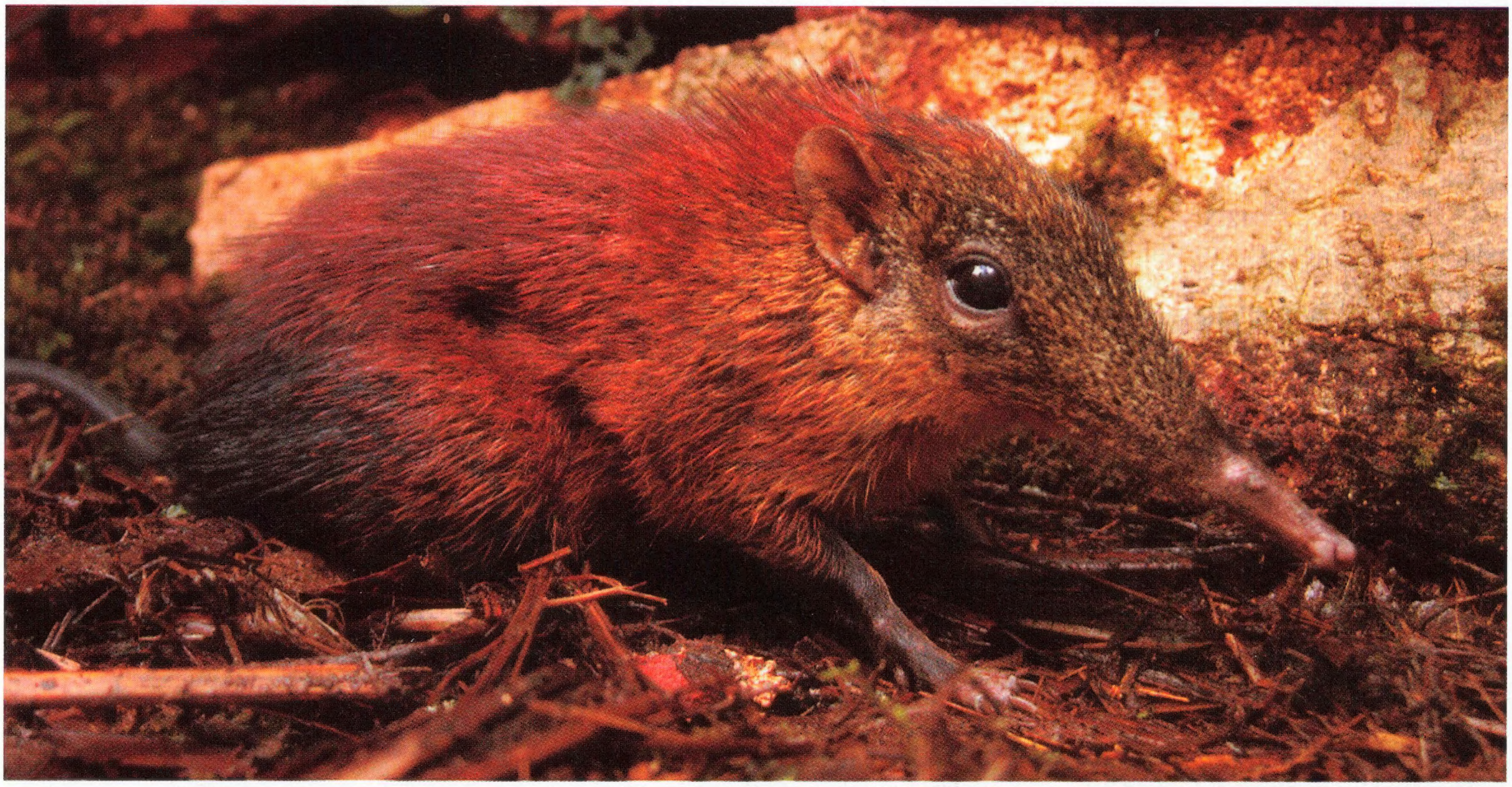
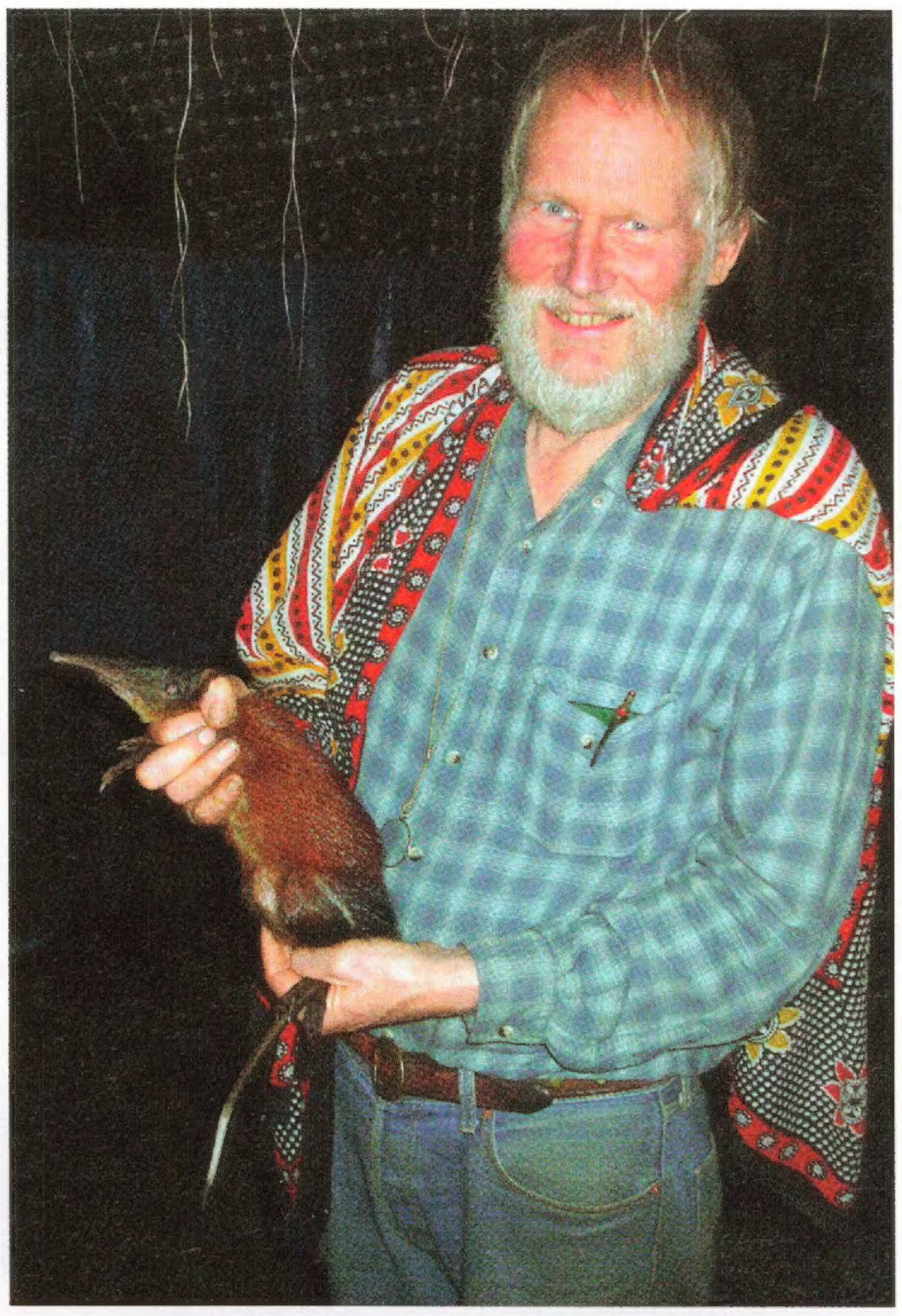


Photo: F. Rovero

ALTHOUGH THERE IS unquestionably much left to be discovered about life on Earth, charismatic animals like mammals are usually well documented, and it is rare to find a new species today—especially from a group as intriguing as the elephant-shrews, monogamous mammals found only in Africa with a colorful history of misunderstood ancestry. Like shrews, these small, furry mammals eat mostly insects. Early scientists named them elephant-shrews not because they thought the animals were related to elephants but because of their long, flexible snouts. Ironically, recent molecular research has shown that they are actually more closely related to elephants than to shrews. Members of a supercohort called Afrotheria that evolved in Africa over 100 million years ago, their relatives include elephants, sea cows, and the aardvark. Until recently, only 15 species of elephant-shrews, also called sengis to avoid confusion with true shrews, were known to science. However, in March of 2006, California Academy of Sciences Research Associate Galen Rathbun and a team of collaborators confirmed the existence of a new species that lives only in two high-altitude forest blocks in the mountains of south-central Tanzania. Their discovery appeared in the February 4 issue of The Journal of Zoology.

"This is one of the most exciting discoveries of my career," says Rathbun, who has studied the ecology, social structure, and evolution of sengis for more than 30 years. "It is the first new species of giant elephant-shrew to be discovered in more than 126 years. From the moment I first lifted one of the animals into our photography tent, I knew it must be a new species—not

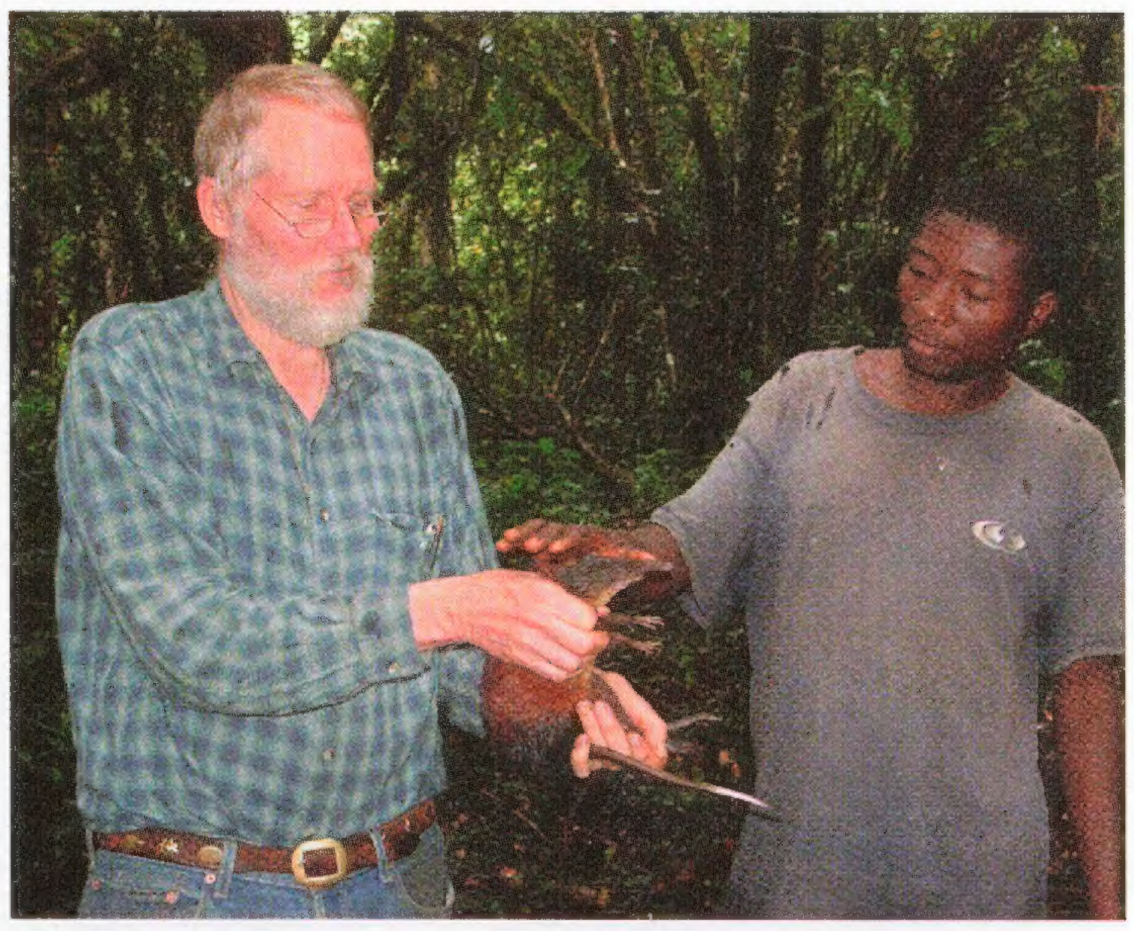


just because of its distinct coloring, but because it was so heavy!" The new species, which has been named the grey-faced sengi (Rhynchocyon udzungwensis), weighs about 700 grams (1.5 pounds), which is more than 25 percent larger than any other known sengi.

The new sengi was first caught on film in 2005, when Francesco Rovero of the Trento Museum of Natural Sciences in Italy set up camera traps inside the remote Ndundulu Forest in Tanzania's Udzungwa Mountains, where he was surveying the region's forest mammals. When the cameras recorded an elephant-shrew that looked unfamiliar, he sent the photos to Rathbun for identification, who determined that the colorful animal appeared to be a new species. In March of 2006, they embarked on a two-week expedition with a team of colleagues to search for specimens that would confirm the discovery.

Although it was supposed to be the dry season, the rains came early, and the traps they had brought with them turned out to be too small for the surprisingly large sengis. But with perseverance and the help of some traditional twine snares, they were able to capture four animals and make 40 observations, confirming the presence of a new species. Its unique features include a distinctive grey face and a jet-black lower rump, as well as a large body size. So far, the new giant sengi (Rhynchocyon udzungwensis) is known to exist in only two populations that cover about 300 square kilometers (115 square miles) of forest in Tanzania's Udzungwa Mountains. The other three species in the genus Rhynchocyon are also rare due to restricted and fragmented forest habitats—one is listed as endangered by the ICUN, another is listed as near-threatened, and the third is on the vulnerable list.

The Udzungwa Mountains are part of a series of ancient and isolated mountain blocks stretching from southern Kenya to south-central Tanzania. The age, isolation and fragmented nature of the forests in these mountains have combined to produce high levels of biodiversity, including many species that cannot be found anywhere else on Earth. In recent years, a number of other new species have been found there, including the Udzungwa partridge, the Phillips' Congo shrew, a monkey known as the kipunji, and several amphibians and reptiles. "This new discovery highlights how exceptionally important the Udzungwa Mountain rain forests are, and how little we know about them," said Rovero. The newly discovered grey-faced sengi is just one of many species in need of protection in the Udzungwa Mountains, which serve as an important dry-season refuge for many animals from adjacent areas. A recent survey suggests that only a few wildlife corridors are still intact enough to provide passage from the mountains to surrounding protected areas. These corridors are critically threatened and will be lost by the end of 2009 without intervention. Recent conservation efforts have resulted in the establishment of the Kilombero Nature Reserve, raising hopes for enhanced long-term protection of some important forests, including Ndundulu where the new sengi was found. Still, without more funding, the legal protection afforded by the reserve will be difficult to enforce. "We hope that new discoveries like ours will help bolster efforts to conserve this spectacular ecosystem," says Rathbun.



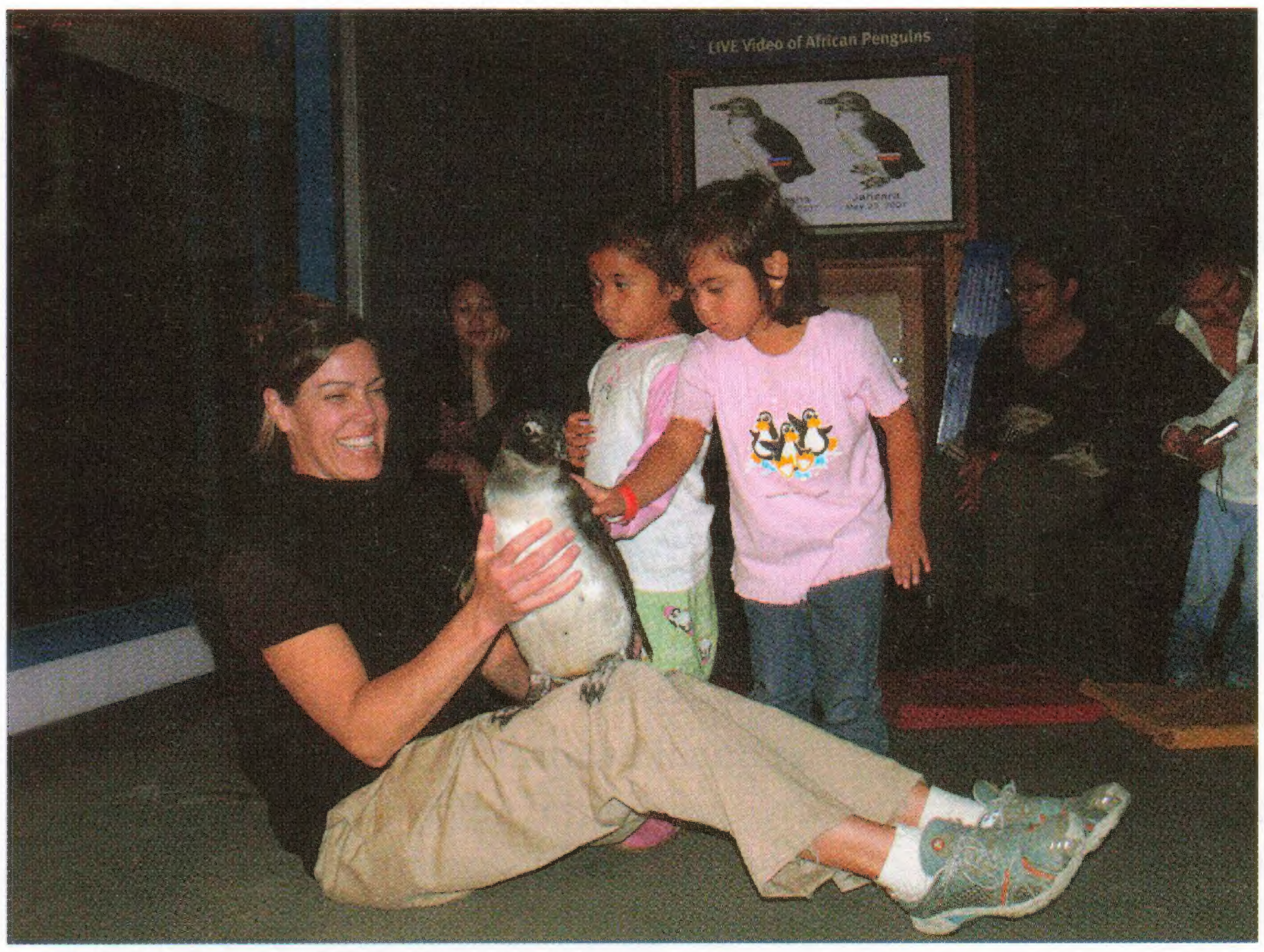
Top left: *The new sengi is known to exist in only two patches of forest in Tnnzania's Udzungwa Mountains, including this region known as Ndunulu Forest.* Photo: F. Rovero

Top right: *Academy Research Associate Galen Rathbun holds a grey-faced sengi.* Photo: D. Ribble. Above: *Rathbun points out the new sengi's characteristic grey face to Ruben Mwakisoma of the Tanzania Forest Conservation Group.*

BAY AREA KIDS NAME NEW PENGUIN CHICKS

When the Academy received four new penguin chicks in October from the Tautphaus Park Zoo in Idaho Falls, it turned to its visitors to nominate names for the newcomers.

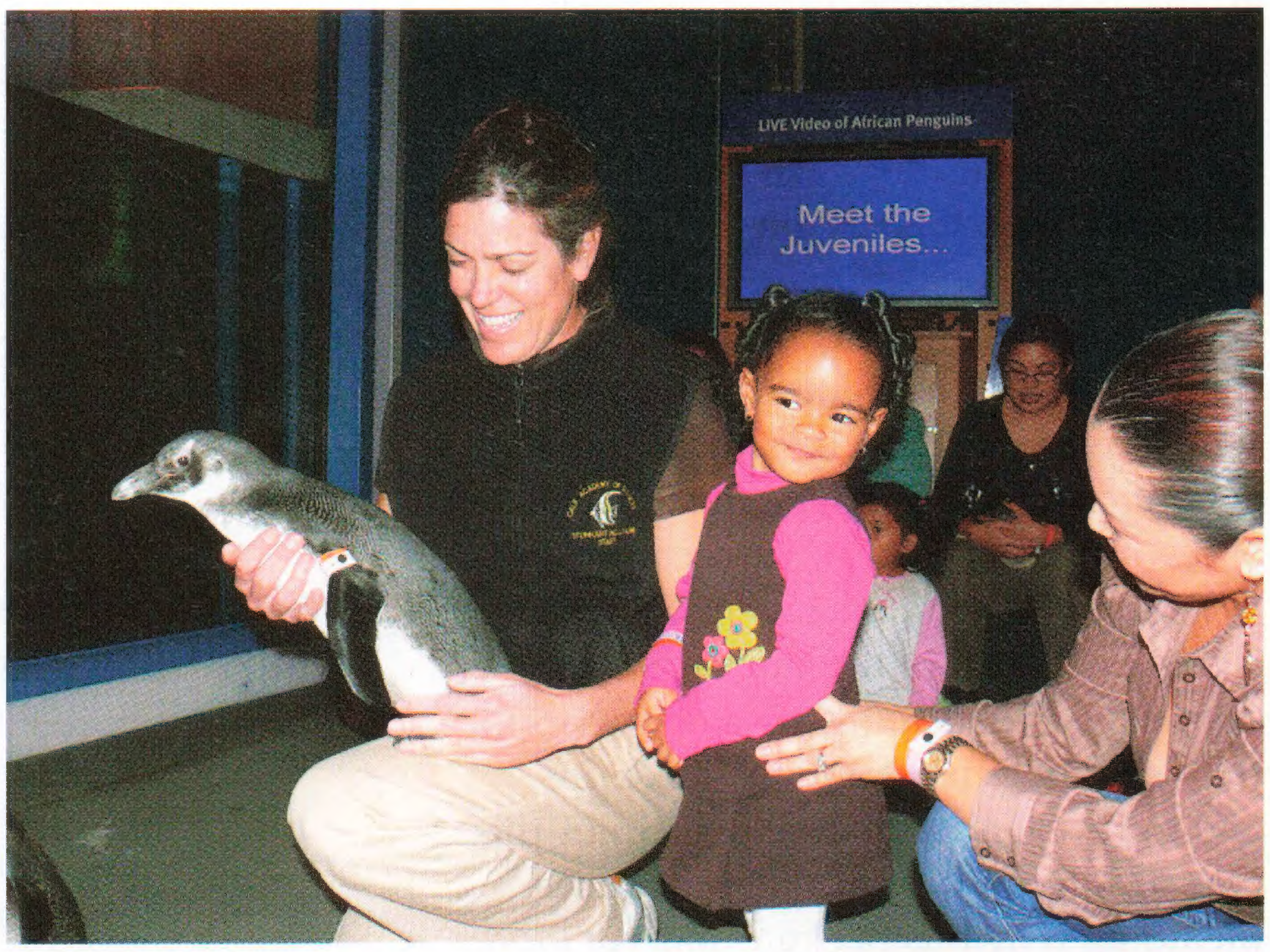
The four kids who suggested the winning names had a once-in-a-lifetime chance to meet a pair of juvenile African penguins, and penguins Dunker and Safara got to see what it's like on the "people side" of their tank wall.



LIVE Video of African Penguins

Ocio

Five-year-old Juliette Espinoza, right, and her cousin get a chance to feel how soft a penguin's feathers are. Juliette suggested the name "Ocio" for one of the chicks.



LIVE Video of African Penguins
Meet the Juveniles...

Jahzara

Biologist Pamela Schaller introducing Jahzara Jones, age 2, to a juvenile penguin. In the fall, visitors will see Jahzara the penguin, and the rest of the colony, in a tank at the end of African Hall.

Dyer

Tristan Gounard, age 13, suggested "Dyer" as a penguin name. Dyer Island, off the coast of Namibia, is a nesting location for African penguins in the wild.

LIVE Video of African Penguins

Adasha

Nehalem Tsunami, age 3, nominated the name "Adasha." The orange and blue bands on Nehalem's left hand correspond to the identification bands that Adasha wears on her left wing.

Special Lectures

Location: Jewish Community Center of San Francisco, 3800 Presidio & California
Tickets: $8 members/ $10 non-members/ $6 students. Tickets can be purchased by calling (415) 321-8000, online at www.calacademy.org, or at the door, when available.

The Evolution of a Universal Moral Grammar

The Leakey Foundation

In Collaboration with the Leakey Foundation

Marc Hauser, Ph.D. **Professor of Psychology, Organismic & Evolutionary Biology and Biological Anthropology, Harvard University**

Thursday, March 20, 8 pm

How do you decide what is morally right and wrong? Using language as an analogy, Hauser argues that humans are endowed with a universal moral grammar that generates intuitive judgments of right and wrong based on an inaccessible code of action. He presents evidence from a large-scale study of the Internet with over 200,000 subjects to justify a dissociation between judgments and justifications, and to reveal a set of core principles that appear immune to cultural influences, including religious background. *For more information: www.leakeyfoundation.org*

The Music Instinct: The Evolutionary History of Human Musical Ability

Steven Mithen, Ph.D.

Professor of Archaeology, University of Reading, UK

Friday, May 30, 8 pm

New research in the study of hominin fossils, archaeological remains, neuroscience, developmental psychology and musicology is generating fascinating insights into the evolutionary history of music. Using pieces of modern music to support his points, Mithen suggests how these developments can be pieced together to gain an understanding of the musicality of human ancestors and how current musical and linguistic abilities evolved.

Conversations at the Herbst Theatre 2008

Presented by City Arts & Lectures, Inc.
All Programs at Herbst Theatre, 8 pm

March 6 Thursday	**Amory Lovins** Co-founder, Rocky Mountain Institute *Natural Capitalism* *Winning the Oil Endgame* *Factor Four*
March 26 Monday	**Bill McKibben** Nature writer, Environmentalist *Deep Economy* *The End of Nature* In conversation with Mark Hertsgaard
April 9 Wednesday	SPECIAL EVENT **Jeffrey Sachs** Director, Earth Institute at Columbia University *Common Wealth: Economics for a Crowded Planet* *The End of Poverty*
April 28 Monday	**Vandana Shiva** Director, Research Foundation on Science, Technology, and Ecology *Water Wars* • *Biopiracy* *Staying Alive* In conversation with Carol Tang
June 9 Monday	**Thomas Lovejoy** Conservation biologist President, Heinz Center for Science, Economics, and the Environment In conversation with Kevin Welch

Lecture: $17 members/ $19 non-members
Series: $90 members/ $102 non-members

This series is made possible, in part, by a grant from the Richard and Rhoda Goldman Fund, the Myers Family Fund, and the Lillienthal Family Fund.

To order tickets, call City Box Office at (415) 392-4400 or visit www.cityboxoffice.com.

The California Academy of Sciences does not process ticket orders for these lectures.

BENJAMIN DEAN LECTURE SERIES

All programs begin at 7:30 pm in Kanbar Hall at the Jewish Community Center of San Francisco, 3200 California Street. Ticket prices: $5 per lecture

Monday, 31 March

The Dark Side of the Universe

Dr. Rachel Bean, Cornell University

Recent cosmological observations have provided an extremely puzzling insight into the nature of the universe. 95% of the universe's contents are invisible or "dark," with 25% being "dark matter" and the majority in a mysterious form labeled "dark energy." Understanding the origins of the dark universe requires collaboration between theory and observation, and between astronomy and fundamental particle physics. This interdisciplinary endeavor represents one of the major challenges in physics today.

Monday, 28 April

The X-ray Universe

Dr. Chris Mauche, Lawrence Livermore National Laboratory

Progress in the field of X-ray astronomy has been rapid since the dawn of the space age: we knew of only a single cosmic X-ray source in 1962, but we had discovered nearly 19,000 by 1999. This talk will be a general overview of the many different—but (almost) always extremely hot, violent, and variable—sources that populate the X-ray sky: our Sun and other stars, X-ray binaries, supernova remnants, galaxies, clusters of galaxies, and million- to billion-solar-mass black holes.

Monday, 19 May

Near-Earth Objects: Finding Them Before They Find Us

Dr. Don Yeomans, Manager, NASA Near Earth Object Program Office

Near-Earth comets and asteroids have both seeded the early Earth with the building blocks of life and altered the evolutionary process with major extinction events. Recent ground-based and space-based observations of these objects make it less likely that we will go the way of the dinosaurs.

March 9

Set clocks ahead one hour as most of the U.S. (except Hawaii, parts of Arizona, most of Indiana, American Samoa, Puerto Rico, and the Virgin Islands) converts to Daylight Saving Time. Formerly starting on the first Sunday in April and ending on the last Sunday in October, this was changed by the Energy Policy Act of 2005 to the second Sunday in March, running to the first Sunday in November. Now, 65% of the year is reckoned in Daylight Saving Time.

March 19

Spring equinox at 9:48 p.m. PDT. Calendars produced for the Eastern or Greenwich time zones list this as occurring on the 20th, but converting to the Pacific, Mountain, and Central time zones crosses midnight and changes the date.

March 21 ○

Full Moon, known to American Colonials as the "Fish Moon," to the Algonquin as the "Worm Moon," to the Choctaw as the "Big Famine Moon," and to the MicMac as the "Spring Moon." Nowadays, by traditional rule, since this is the first full Moon of Spring, the following Sunday is observed as Easter Sunday.

April 20 ○

Full Moon. known to the Choctaw as the "Wildcat Moon," to the Ponca as the "Rains Moon," and to the Dakotah Sioux as the "Moon When Geese Return in Scattered Formations."

April 22 ☄

Peak of the ***Lyrid meteor shower***, named after the constellation Lyra the Harp, from which the meteors appear to radiate. Unfortunately, not a good year for this shower, occurring with a waning gibbous Moon whose light will interfere.

May 5 ☄ ●

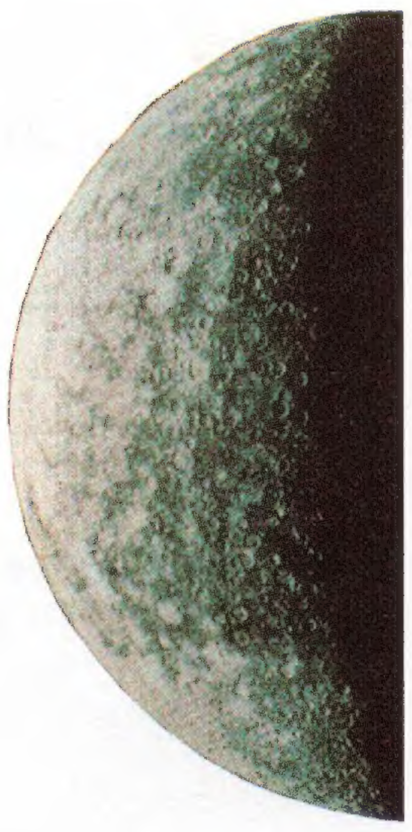
The peak of the ***Eta Aquarid meteors*** coincides with a ***new Moon***, so observing of this good shower won't be spoiled by moonlight – look for about 15-25 meteors per hour, radiating from the faint stars of Aquarius the Water-Carrier, which rises a few hours before dawn. Although new Moon is not routinely noted here, this one occurs about a half-day from perigee, or the Moon's closest approach to Earth, therefore causing ***higher tides*** than usual.

May 19 ○

Full Moon, called the "Moon to Plant" by the Dakotah Sioux, the "Moon of Summer Begins" by the Ponca, and the "Moon When Ice Goes Out of the Rivers" by the Nunamiut of the Far North.

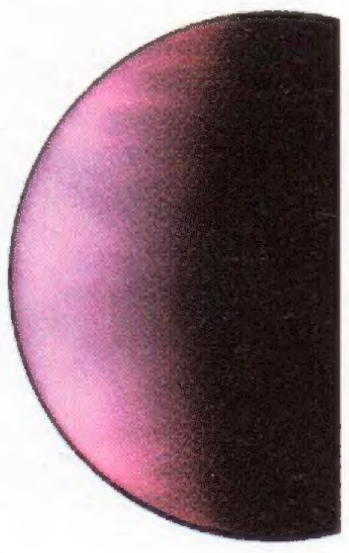
The Planets

Mercury



The speediest planet makes an ever-so-brief appearance in the predawn sky as March begins, appearing very low in the east-southeast. It quickly drops into the Sun's glow, disappearing for most of April, but reappears in the evening sky after sunset late in the month and into May. The crescent Moon's visible passes are near Mercury on the morning of March 5th (difficult in the glow of twilight, but with brilliant Venus very close) and on the evening of 6th.

Venus

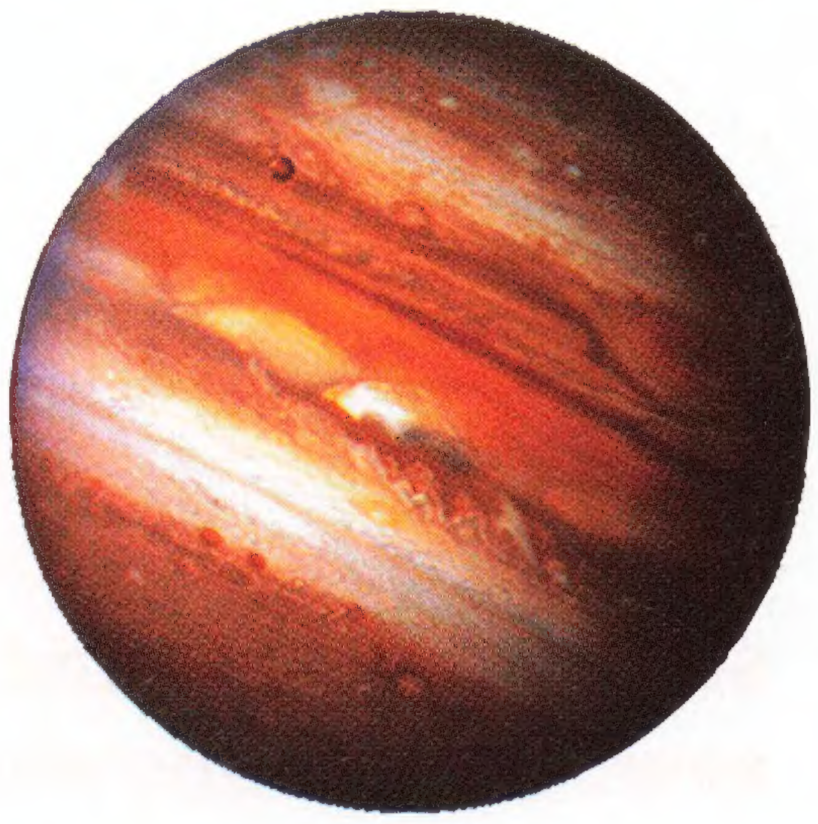


The brightest of the planets is a morning object that, like Mercury, is only briefly visible before dawn at the beginning of March and in the process of descending into the Sun's glow. Moving much more slowly than Mercury and only slightly faster than the Sun, Venus spends the season lost in the glare as it inches behind our star, not to reappear in the evening sky until Summer.

Mars

In March, the Red Planet appears nearly overhead at sunset, at the feet of Gemini the Twins. It spends the entire season shifting westward with the sky, appearing high in the west by May. The Moon swings nearby for visits on the evenings of March 14th, April 11th, and May 9th & 10th.

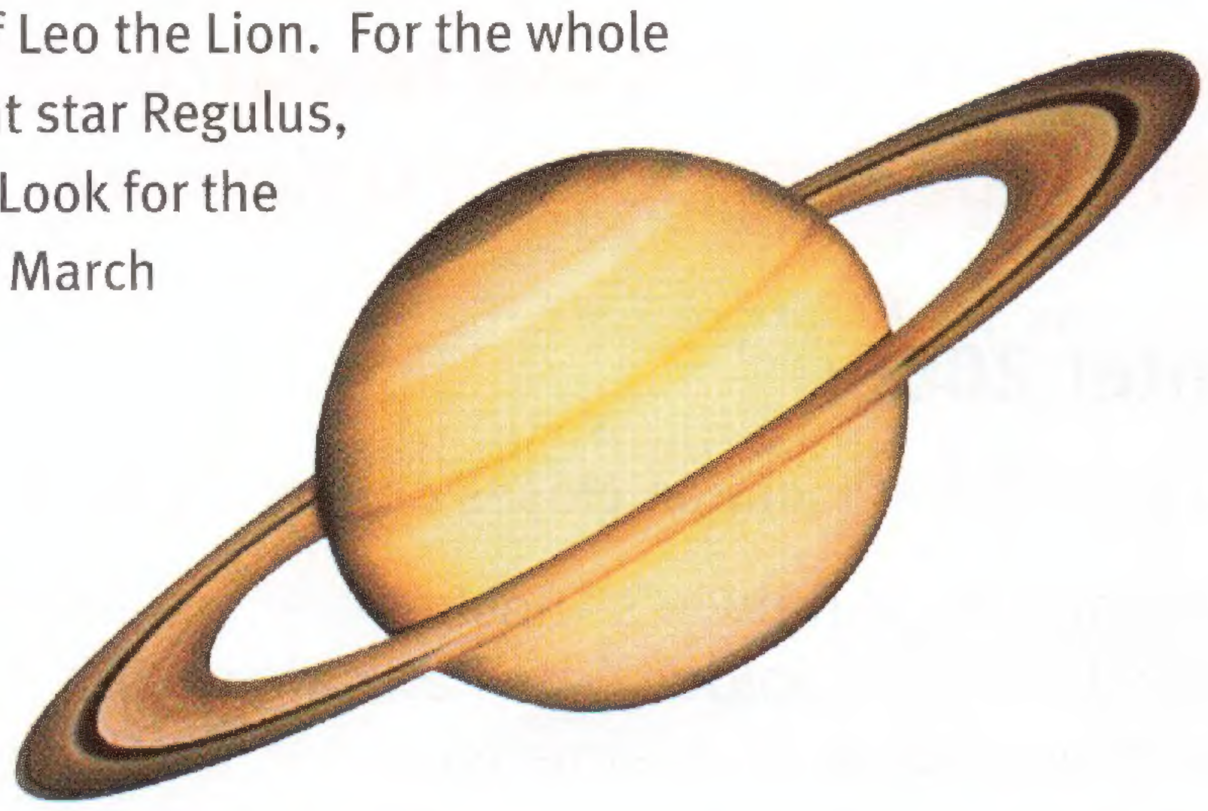
Jupiter



The King of the Planets begins the season as a predawn object only, rising about 2 hours before dawn. Then, rising a few minutes earlier each morning, it eventually becomes a late-evening riser, peering over the southeastern horizon just before midnight in late May. The Moon pairs with Jupiter on the mornings of March 2nd & 3rd, March 30th, and April 27th, and on the evening of May 23rd.

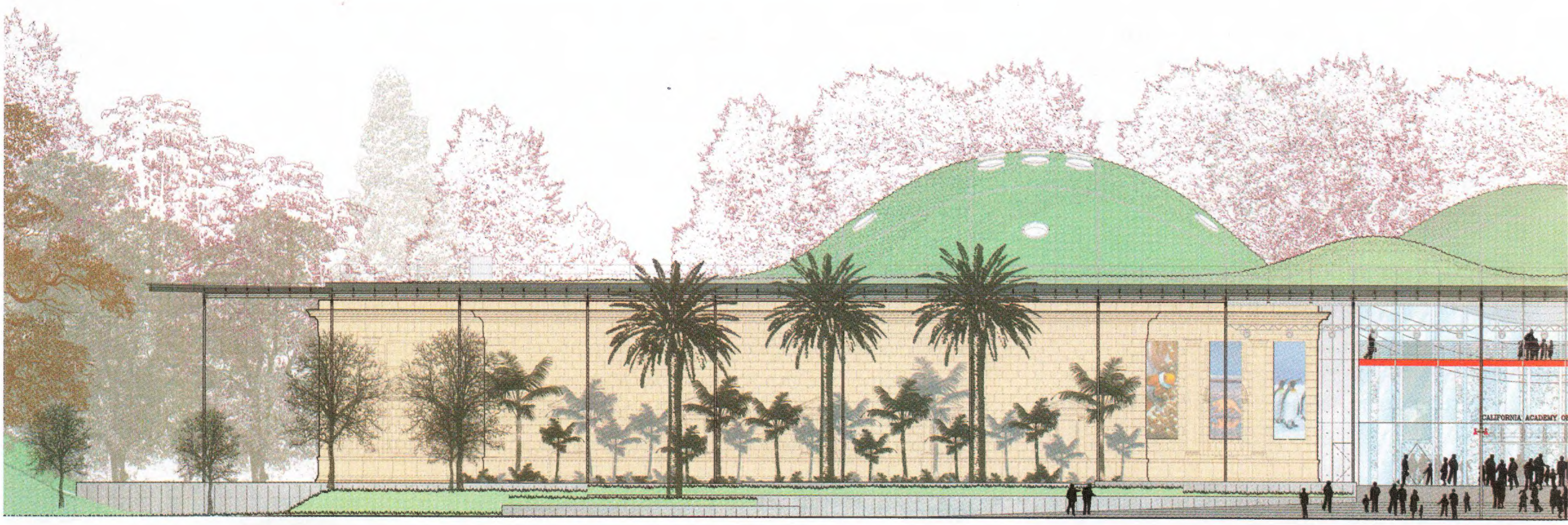
Saturn

Just past its February 24th opposition, the Ringed Planet is rising at sunset and is visible for most of the evening, gradually traversing westward against the stars of Leo the Lion. For the whole season, it lumbers slowly near the bright star Regulus, which represents the heart of the Lion. Look for the waxing Moon nearby on the evenings of March 18th, April 14th, and May 12th.



	SUNRISE	LOCAL NOON	SUNSET
MARCH 1	6:40 AM PST	12:22 PM PST	6:04 PM PST
APRIL 1	6:54 AM PDT	1:14 PM PDT	7:33 PM PDT
MAY 1	6:13 AM PDT	1:07 PM PDT	8:01 PM PDT

(Times are for San Francisco, CA, and will vary slightly for other locations.)



GREAT MIGRATION TIMELINE

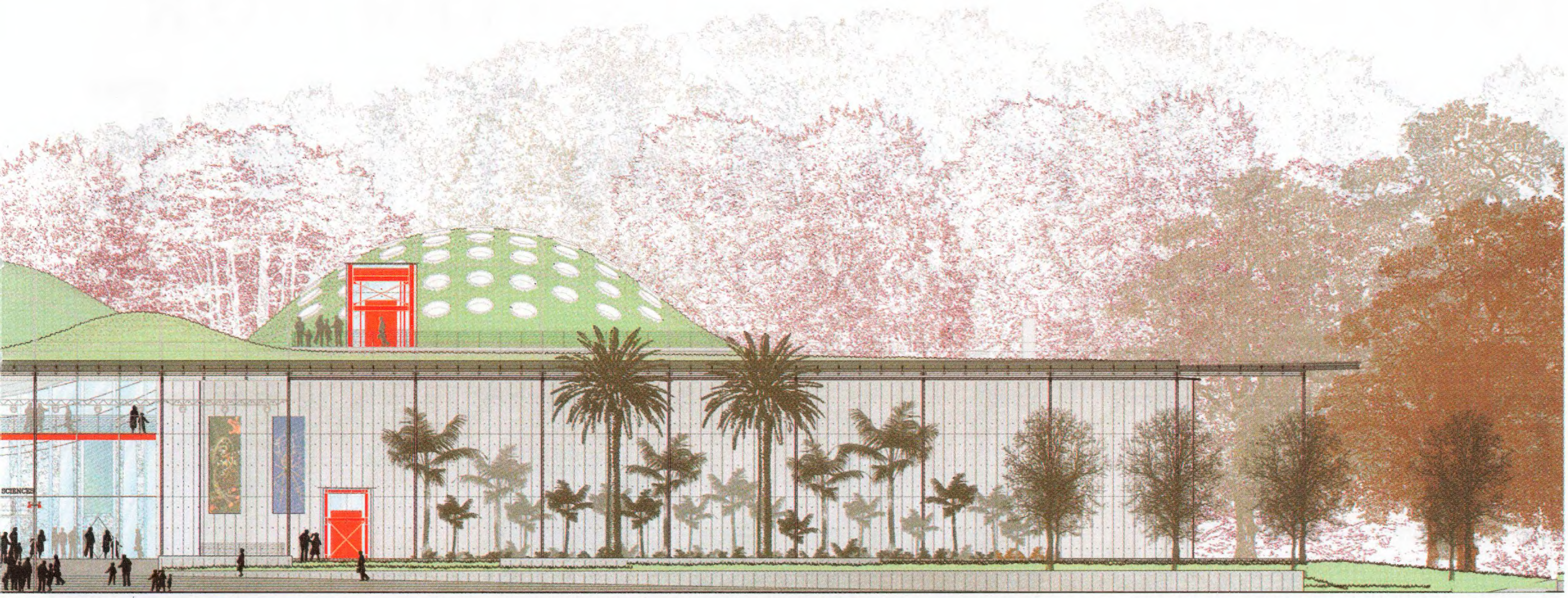
The Academy's doors may be temporarily closed to the public, but behind-the-scenes, staff, volunteers and movers are as busy as ever. The months ahead are packed with moving milestones as thousands of live animals and extensive research collections migrate back to Golden Gate Park.

Winter 2008:

- Howard Street location closes on January 6, 2008
- Thousands of "Darwin's" finches are nested into new drawers in Golden Gate Park (along with 107,000 other bird specimens)
- Monarch, the last California grizzly bear, boards the moving van (along with 30,000 other mammal specimens)
- Two full-sized Eskimo kayaks, 500 Japanese folk toys, and 16,000 other cultural treasures are packed for the move
- First live fish and corals are introduced to the Philippine Coral Reef tank
- African Hall diorama animals return to their recreated ecosystems
- Nearly 3 million beetles (and over 11 million other insects and arachnids) make the big move
- After a month long trip to the freezer to prevent pest infestations, nearly 2 million pressed and dried plant specimens are installed into compactors at the new Academy.
- Sharks, rays, and a green sea turtle are introduced to the Philippine Coral Reef tank

Spring 2008:

- The alligator gars return to Golden Gate Park, taking up residence across the aisle from their look-alikes in the Swamp tank
- Over 2 million fish specimens preserved in 200,000 jars of alcohol are packed and moved
- Giant Galapagos tortoise shells board the moving vans



- A 1,350 pound quartz cluster is packed for the move, along with jade boulders, precious gems, and meteorites that are billions of years old
- The African penguins march into African Hall
- The first fish swim through a kelp forest inside the California Coast tank
- Arapaimas and other Amazonian fish are introduced to the Flooded Amazon tank in the rainforest dome
- Six-foot-long pile worms preserved in glass tubes join sea spiders, sea urchins, jellies, and microscopic diatoms on the migration.
- The first rainforest birds arrive in Golden Gate Park
- Live bats are introduced to the Bat Cave on the Borneo level of the rainforest
- Alligators (one of which is an albino) once again take up residence in the Swamp tank
- An enormous anaconda coils itself around a branch in the rainforest dome

Summer 2008:

- Check your mailbox – the Summer issue of the Member Publication features a brand new look
- More than 230,000 books, journals, and maps from the Academy Library are moved into their new home
- Jellyfish begin to bob up and down in a new tank in the park
- Hundreds of fish are introduced to new tanks in the Water Planet exhibit
- The rainforest birds begin to fly through the Costa Rican rainforest canopy
- Colorful butterflies are introduced to the rainforest dome
- The last pieces of coral are planted in the Philippine Coral Reef tank
- The new Academy opens to the public on Saturday, September 27

INTRODUCING THE CENTER FOR COMPARATIVE

A State-of-the-Art DNA Research Facility Will Debut in the New Academy

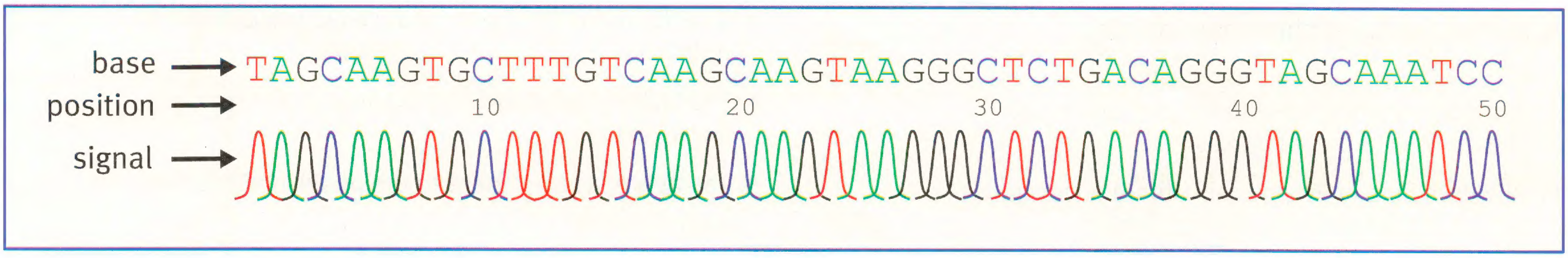
Photo: Rachael Tom

Dr. Brian Simison in the future location of the Center for Comparative Genomics in the new Academy.

DNA SEQUENCING IS PERHAPS best known today for its role on CSI, but this breakthrough technique is used for much more than just solving television crimes. Every day, biologists at institutions like the Academy sequence the DNA of plants, animals, and other organisms in an effort to better understand the diversity and evolution of life on Earth. Through a multi-step process, they translate life forms into strings of adenine, guanine, thymine, and cytosine—the four molecular "bases" that make up DNA. The sequence of these bases—for example, AGTCTGGCATTTCGGAA… and so on—is distinct for each organism, creating a unique genetic blueprint for everything from bacteria to human beings.

To sequence an organism's DNA, you need a sample of its cells. Whether it's from the hair, antenna, leaf, flipper, blood, or saliva, almost every living cell contains DNA. The first step is to digest the sample in a cocktail of chemicals and enzymes that separates the DNA from all other components of the cells. Next, you wash it all through a filter that "sticks to" the DNA and lets the other material pass through as waste. Then you amplify—or make many copies of—the specific region of DNA you want to sequence using a process called the Polymerase Chain Reaction (PCR). Once you have billions of copies to work with, you essentially repeat the process—except this time, you attach fluorescent "tags" to the products that allow you to read your results. Finally, you load your products into a sequencer machine, where they travel down thin capillary tubes and pass a laser beam. The laser causes the fluorescent tags to emit light, and depending on the color of the light, the machine records an A, G, T, or C.

And voilà—you now have the DNA sequence of the gene you amplified: AGTCTGGCATTTCGGAA… and so on. Sound complicated? It is. It takes large



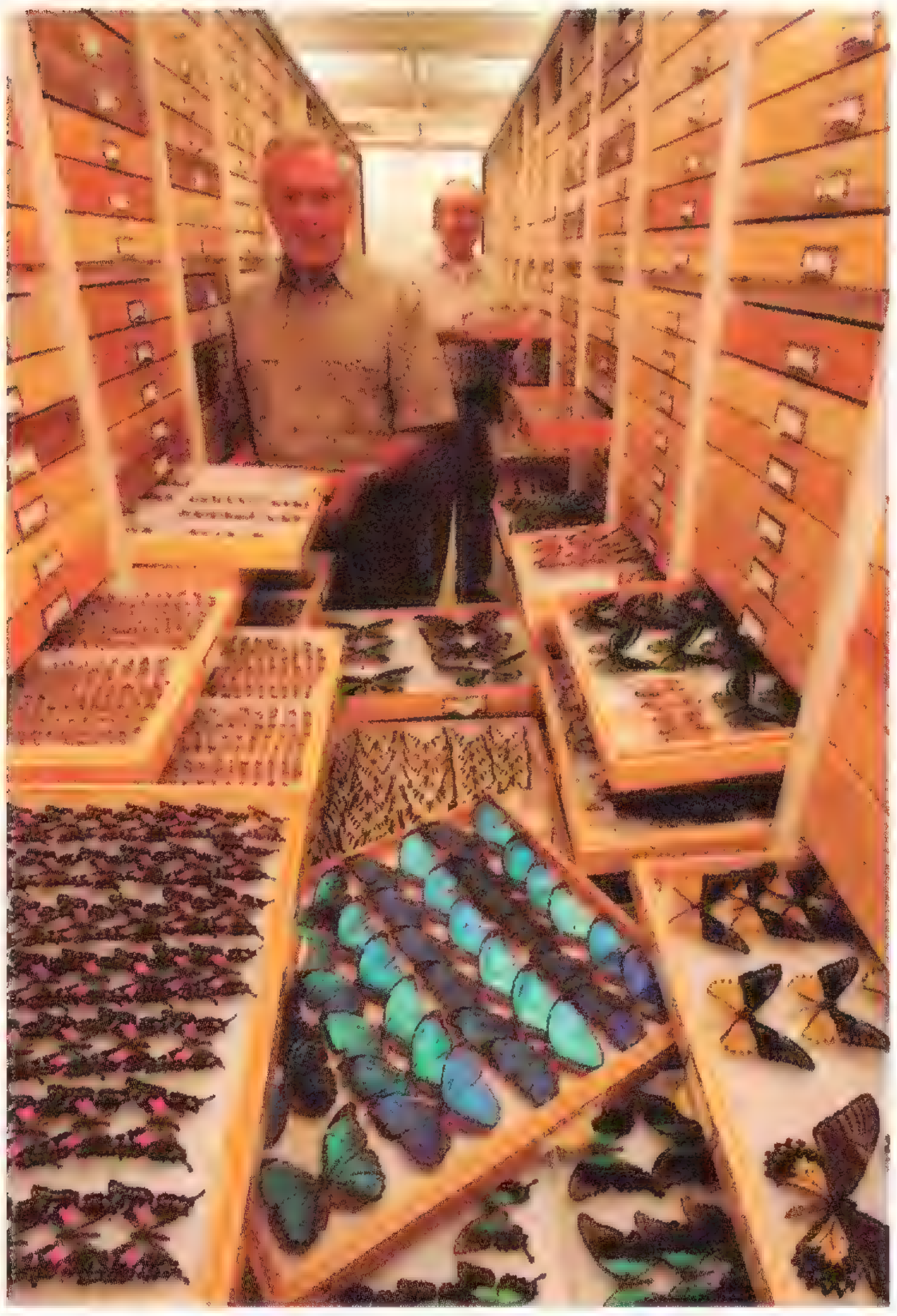
As a sequencer processes a DNA sample, it produces a "chromatogram." The peaks represent the light reflected by each fluorescently-tagged base as it passes the laser.

GENOMICS

doses of both training and patience to sequence and interpret DNA data.

Meet Dr. Brian Simison. He manages the Academy's molecular lab, which was founded in 1987 and serves as the site of DNA extraction and sequencing work. With curators, post-doctoral fellows, students, interns, and assistants from every research department using the lab, the traffic is heavy and the specimens are diverse—DNA samples could be from owls today, frogs tomorrow, and orchids the next.

The pièce de résistance of the lab is its ABI 3130 XL sequencer machine. It can process 16 samples simultaneously and churn out 192 sequences in 24 hours. The operation of the machine is delicate and requires strict attention to protocol. Only Simison and two others are allowed to operate it.



A small sample of the 20 million specimens on which Academy scientists can base their phylogenetics research.

"You have to be very careful," Simison says. "For example, an air bubble could travel down the cathode tube and destroy it. It costs $1,500 to replace the tube. That's a costly mistake."

Once Academy scientists obtain the DNA sequences, they then use a suite of computer algorithms to compare sequences from different organisms and infer their evolutionary relationships. The end result is akin to a family tree. Oftentimes, to strengthen their results, the sequence data is supplemented with data from anatomical comparisons—such as the presence of poison glands, the number of gills, or the length of spines. The final evolutionary "tree" is based on the similarity of the sequences and anatomical features between organisms.

This type of research, known as "phylogenetics," forms the core of the behind-the-scenes work at the Academy. Phylogenetics brings order to the chaos of life. It provides insight into how life attained the incredible diversity that exists today and informs crucial conservation decisions. With more than 20 million animal and plant specimens collected over the past 155 years in its research library, and current expeditions ranging all over the world, the Academy has an enormous, ever-growing record of life on which to base its phylogenetics research.

For some time now, biologists have used a handful of genes—each usually 1000 bases or less in length—as a proxy for the entire organism. But the breakthroughs of a relatively new field known as genomics make it possible to look at the entire DNA sequence (or "genome") of an organism. Though comparing genomes may take more time and more computing power—the genome is 4 million bases long in the bacterium *Escherichia coli*, and 3 billion bases long in humans—the insights gleaned are much more comprehensive, since every single gene, every single region of DNA, is covered. This potential bonanza of information is propelling phylogenetics to the next level.

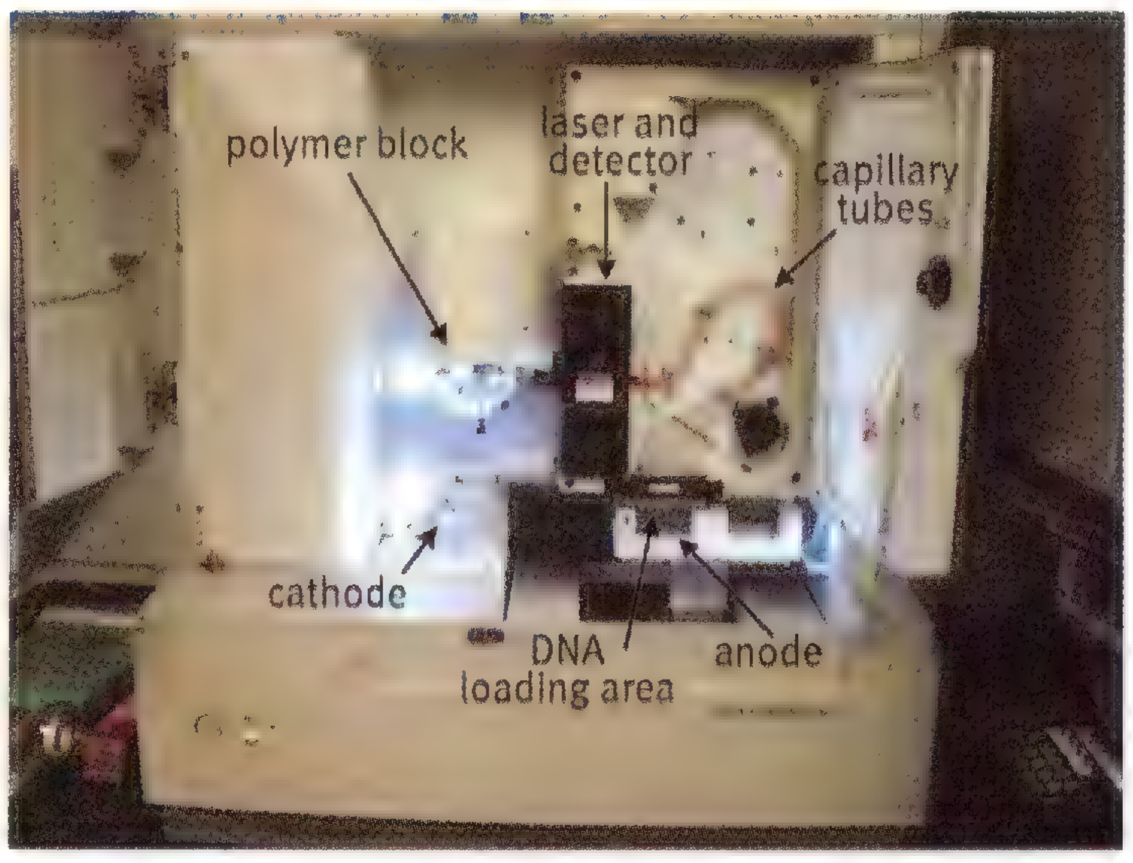


Photo: B. Simison

Above: *The Academy's ABI 3130 XL sequencer. Negatively-charged DNA travels away from the negatively-charged anode, through the thin capillary tubes, past the laser and detector, and then finally into the positively-charged cathode.* Below: *The pump that delivers polymer—the substance that the DNA travels in—to the sequencer's capillary tubes.*

Enter Dr. Brian Simison once again. In the spring of 2007, he added new job responsibilities to his role at the museum when he became the Academy's newest curator—Curator of

Comparative Genomics. In light of his background, it's easy to see why he was chosen for this new position. Simison has consistently placed himself at the forefront of new technologies. In the 1980s, following his undergraduate studies, he worked at a biotechnology company where he gained lab skills that were cutting-edge at the time, including the first iterations of PCR and sequencing. In the early 1990s, while earning a Ph.D. in evolutionary biology at UC Berkeley, he was part of a team that designed a new-fangled thing called a "website" for the UC Museum of Paleontology. It was one of the first 50 websites ever made.

Simison then entered a post-doctoral fellowship at the Joint Genome Institute in Walnut Creek, CA, one of 20 partner institutes across the world hoping to achieve what no one had before—sequencing the entire human genome.

"While my work there was on gastropods, I was able to see first-hand the technical innovations spawned from the Human Genome Project," he says. "Most of the applications were medical, but they could also be adopted for evolutionary biology."

An example of one of these applications is the microarray. This technique allows you to visualize and compare the active genes from two different sources—for example, a tadpole compared to a frog. A gene that is active in one and not the other may indicate what drives the animal's drastic metamorphosis. Only through genomics can you make a thorough survey of all the possible genes involved. While microarray analysis was originally used in a medical context, such as comparing cancerous liver cells to healthy liver cells, evolutionary biologists are now adopting it to decode how complex, living creatures come into being.

To recognize the importance of the genomics frontier, and to position itself firmly in the thick of it, the Academy recently established the Center for Comparative Genomics with Simison at its head. In his new role, Simison will upgrade the existing molecular lab into a state-of-the-art genomics facility.

"The Center for Comparative Genomics will be a collection of labs, tools, and equipment in the new Academy where our scientists can use the latest technologies, derived from the Human Genome Project, and apply them to the field of evolutionary biology," says Simison. "Whereas the molecular lab at Howard Street consisted of three rooms—one for DNA extraction, one for PCR and gels, and one for sequencing—the new Academy will have seven rooms as part of the genomics center: one room each for DNA extraction, PCR, gels, sequencing, and computer analyses, plus two offices."

On Simison's shopping list for the new center are more sequencer machines and a High Performance Computing Cluster—a supercomputer that can do in 10 hours what current computers may take 30 days to do. Once complete, the genomics center will expand and expedite the research methods available to Academy scientists. They will be able to sequence whole mitochondrial genomes of the organisms they are studying, sequence multiple individuals from the same population, compute evolutionary trees more quickly, and explore new techniques like microarrays.

"Not only will our existing staff benefit," says Simison, "but the suite of offerings will attract new post-doctoral fellows, students, and guest researchers. It will further enrich our scientific program at every level."

From sequencing single genes to sequencing complex organisms, DNA technology has come a long way in just a few decades. As the Center for Comparative Genomics shows, the Academy's scientific program will continue to evolve as more innovations arise in the 21st century and beyond.

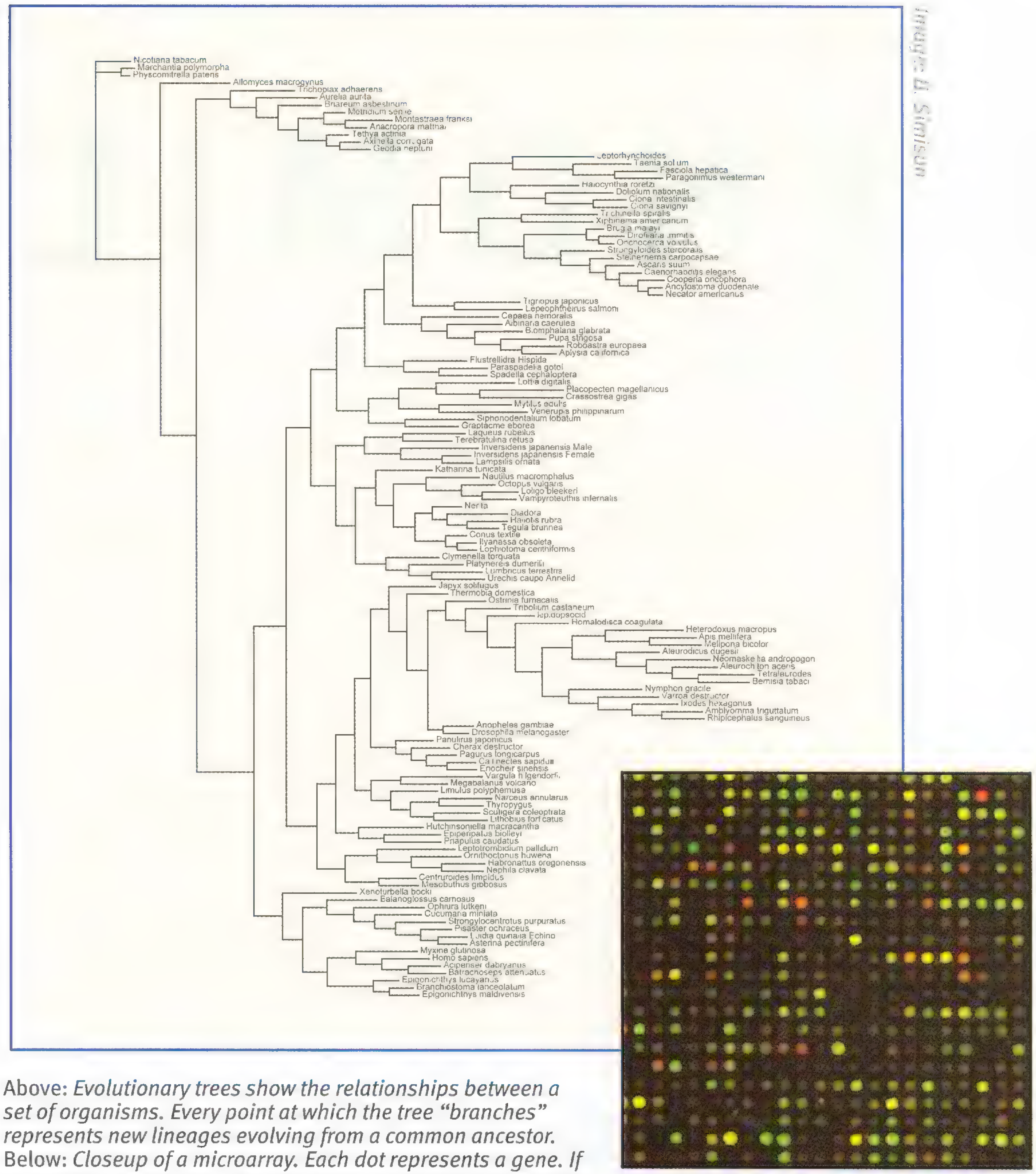


Image: B. Simison

Above: *Evolutionary trees show the relationships between a set of organisms. Every point at which the tree "branches" represents new lineages evolving from a common ancestor.* Below: *Closeup of a microarray. Each dot represents a gene. If a dot emits green light, then the gene is active in one sample; red light, the gene is active in the other sample; yellow light, the gene is active in both samples.*

ACADEMY TRAVEL PROGRAM

The mission of the Travel Program is to offer Academy-led tours that place members in the context of specifically chosen natural environments. Teaching, understanding, and conservation are our goals.

ALASKA'S HIGH ARCTIC

June 5 – June 15, 2008

Leaders: Dave and Bev Kavanaugh

The delicate balancing act between energy exploration and environmental conservation in Alaska's remote High Arctic region has been a hot-button political issue for decades. In the context of the debate over global climate change, this fascinating program offers an unique opportunity to learn firsthand about pressing issues in this ecologically fragile environment, among them the impact of rising temperatures on traditional ways of life and the area's wildlife. Visit research stations and petroleum production facilities, meet with conservationists and field scientists, and explore the Arctic National Wildlife Refuge and Bristol Bay. Marvel at the grandeur of Alaska during flights over the Brooks Range and vast tundra, and gain valuable perspectives on the human and cultural aspects of this debate while staying in local communities like Barrow, the northernmost town in America.

Cost: $9,995/person, based on double occupancy, plus airfare

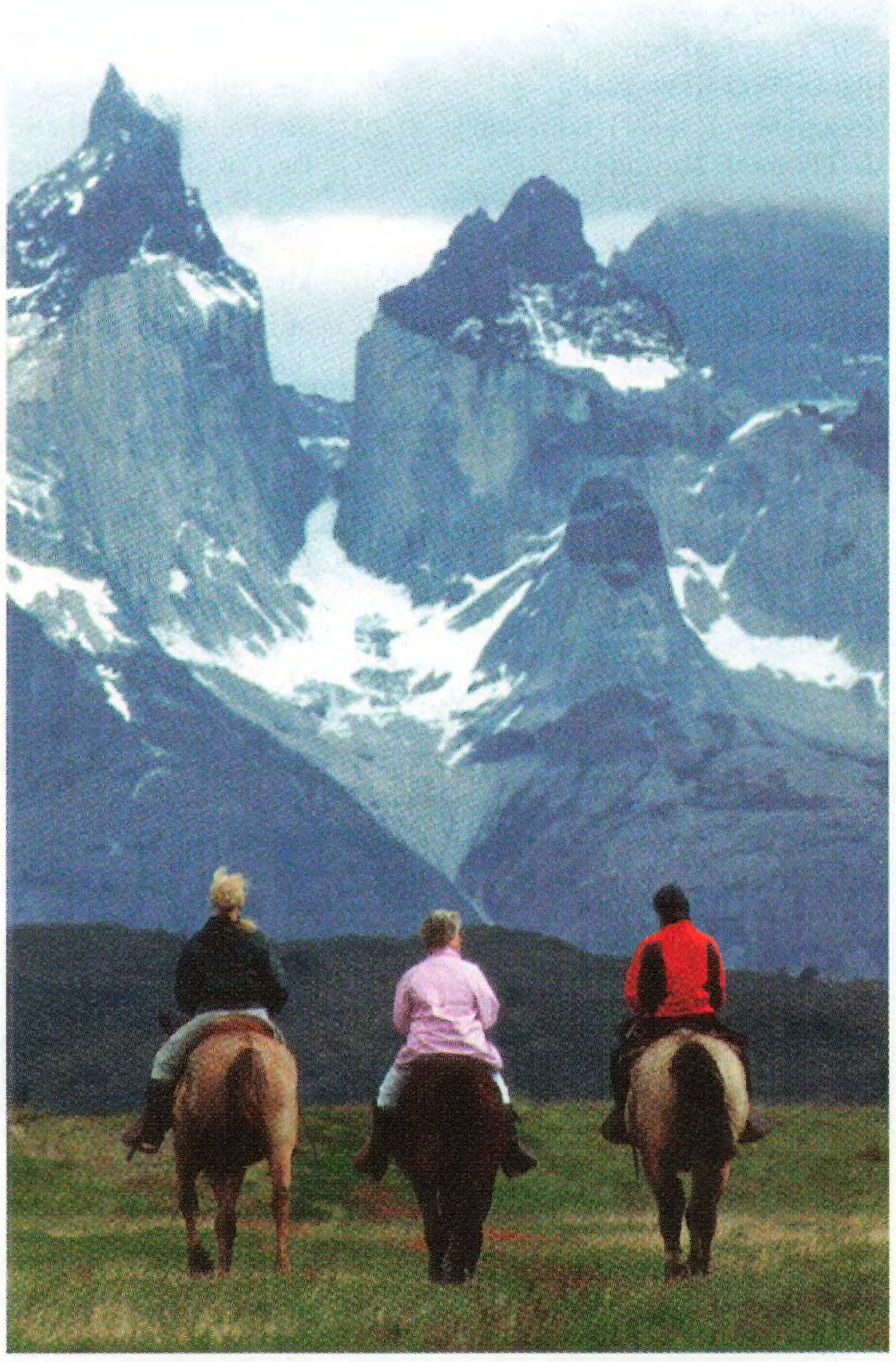
PATAGONIA: CROWN JEWEL OF SOUTH AMERICA

(with optional pre- and post-extensions to the Atacama Desert and Iguazu Falls)

Aboard the *Via Australis*

November 4 –17, 2008

Leaders: Dr. Terry Gosliner and Bonnie Gosliner



Enchanting travelers since man first trod its wild and isolated terrain, Patagonia is a mythic land of ancient glaciers, towering peaks, exotic wildlife, and primeval forests.

Begin this adventure amid the old world charm of Santiago, savoring its lively street scenes, local cuisine and fine wines. Indulge in five-star comforts at the word-renowned Explora Lodge in the heart of Torres del Paine National Park, among the world's most stunning and diverse landscapes boasting dramatic scenery and a unique array of animal life. Embark the *Via Australis* in Punta Arenas to cruise the magnificent fjords and glaciers around Cape Horn, the Beagle Channel, and the Straits of Magellan before disembarking in Ushuaia, the world's southernmost town. Conclude the trip in cosmopolitan Buenos Aires.

Cost: approximately $6,990/person
Based on double occupancy, plus airfare

For brochures or additional information, please contact the Academy Travel Office. Phone 415.901.8129 or 800.853.9372; E-mail: calacademy@hcptravel.com; Travel web page: www.calacademy.org/geninfo/travel

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Charter Memberships, at the current prices, are available through March 31, 2008. Membership prices (new and renewing memberships) will increase after that date in preparation for the Academy's reopening in Golden Gate Park. Charter Members will be invited to preview events at the new Academy and receive a special gift.

For more information, visit www.calacademy.org, call 800.794.7576, or email membership@calacademy.org.

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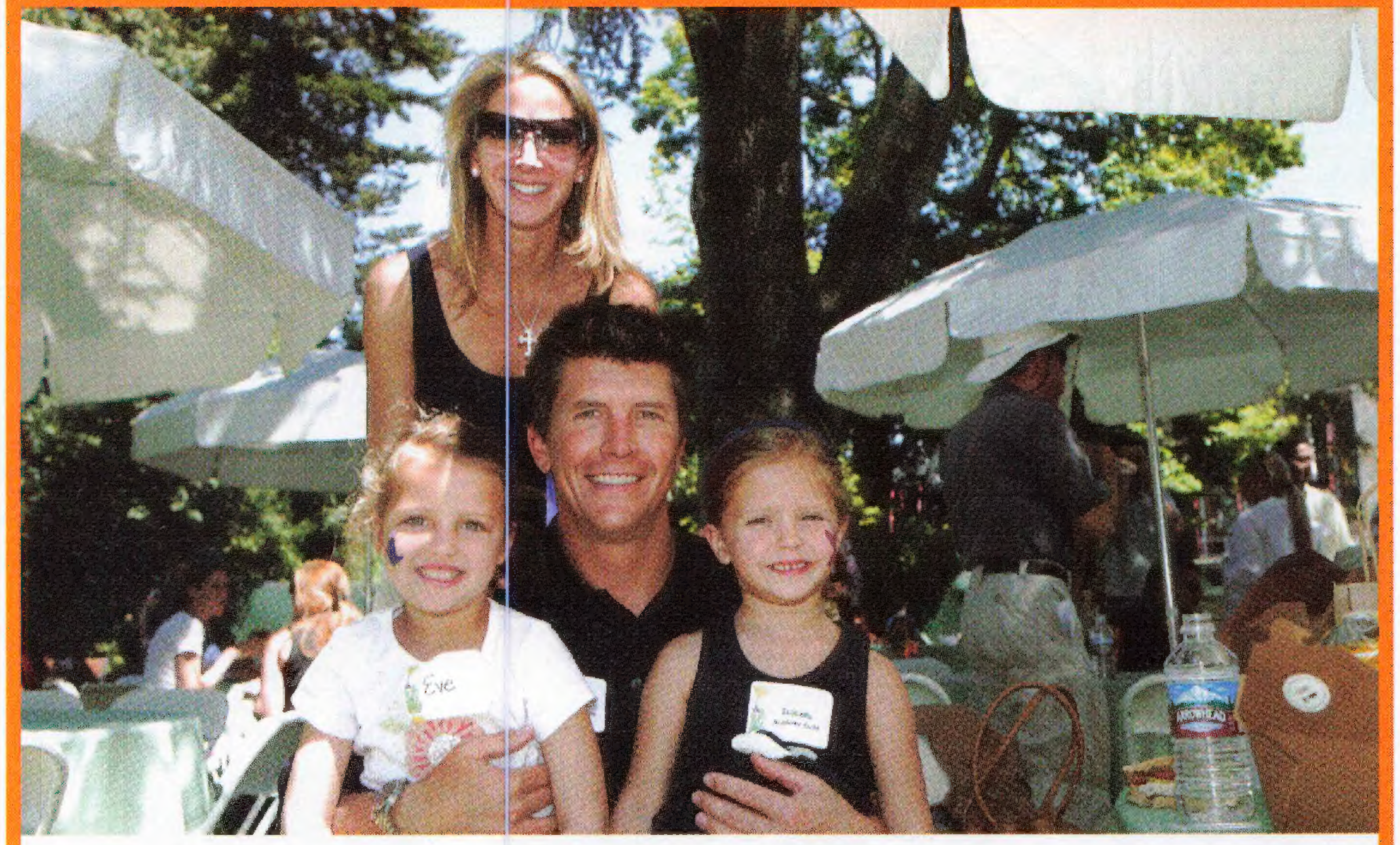

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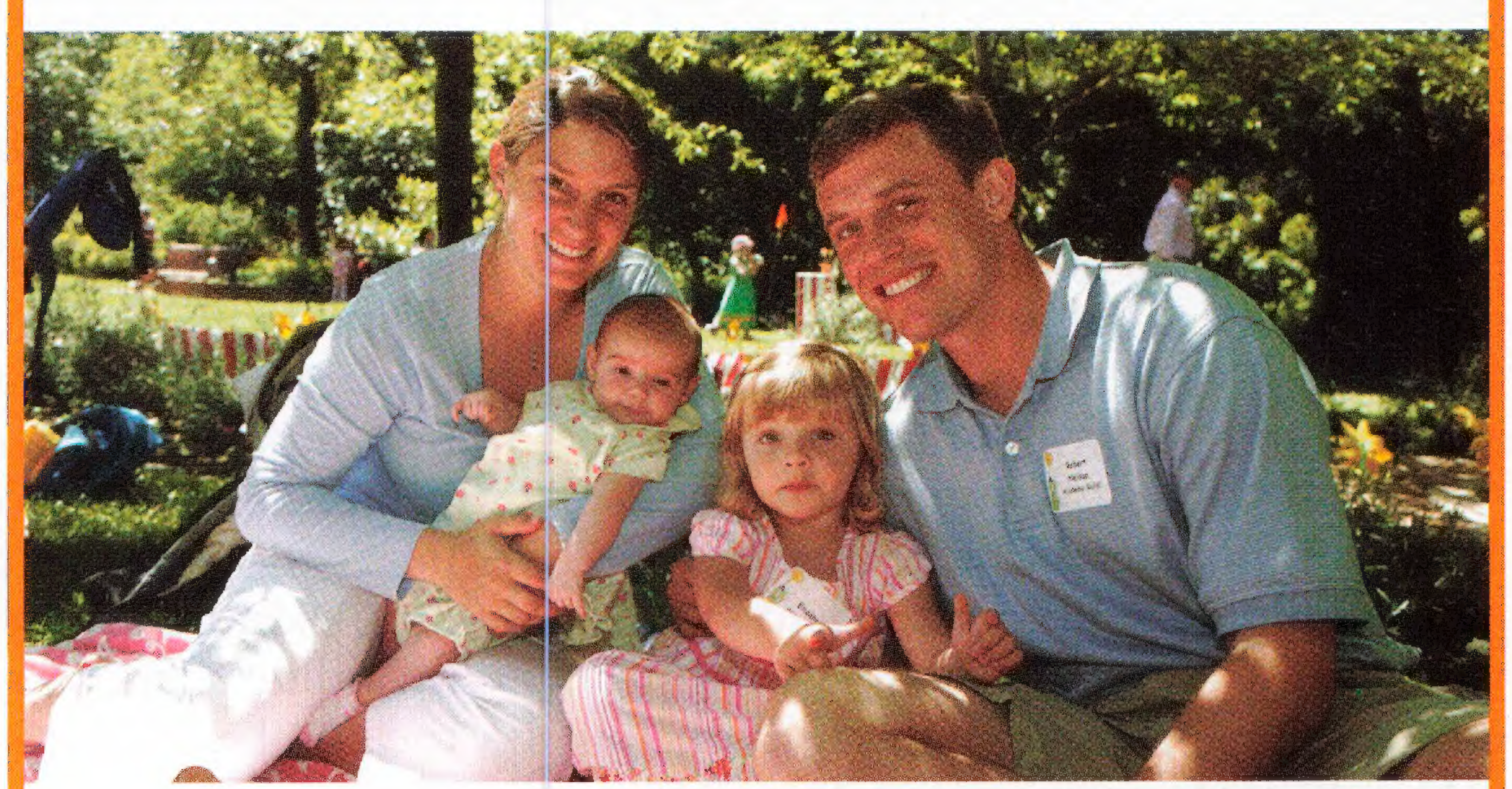


To learn more about the Guild, contact Jeanna Yoo at 415.321.8414 or jyoo@calacademy.org.

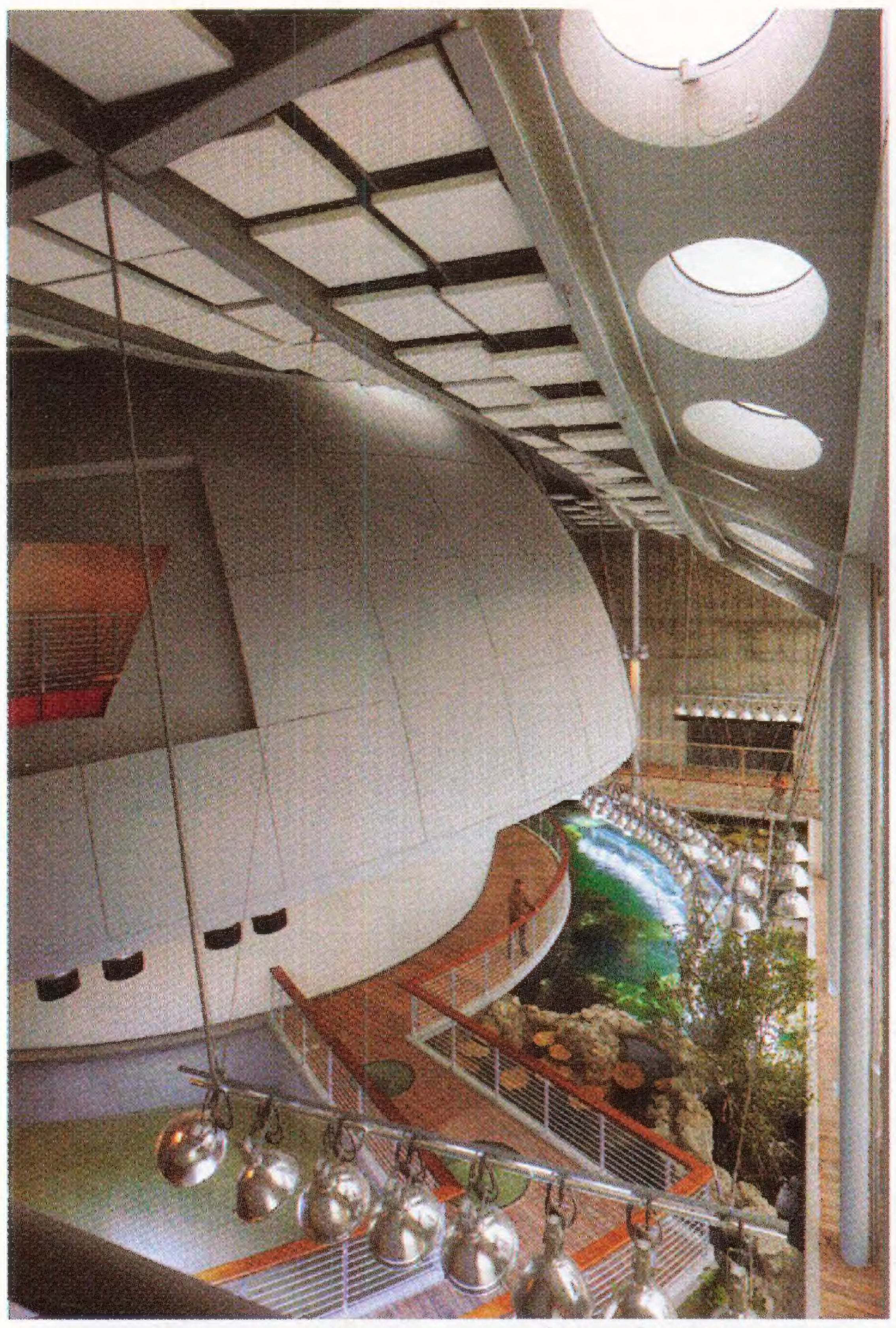
EASTWOOD TRADITION

Over thirty years ago, Yaye Herman came to the Academy as a Steinhart Aquarium docent with a remarkably diverse background. She was a nutritional microbiologist and had a distinguished career in the U.S. Army. She travelled widely and was actively involved with other organizations in the Bay Area. During her years at the Academy, she led thousands of children on tours and worked in the veterinary lab, became the staff microbiologist and produced Aquarium photographs, working often with John McCosker. She loved the education program and the Aquarium and supported both generously. When Yaye died in 2007, Dr. John McCosker, Director Emeritus of the Steinhart Aquarium, said, "I will always remember Yaye by her big smiling eyes, wide grin, and lovely laughter." She was textbook proof that, "enormous things often come in very small packages."

We are honored that Yaye left a bequest of her family home in San Francisco to be sold to support the Academy. It is a memorial to her decades of involvement at the Academy.

Yaye Herman loved to inspire and educate and hoped that her gift would encourage others. If you are interested in learning about the many benefits of leaving a gift of real estate (and other legacy gifts) to the Academy, please contact **Louise Gregory at 415.321.8407 or lgregory@calacademy.org.** ***And visit the Academy's planned giving webpage on www.calacademy.org by clicking on Give, and then Planned Giving.***

NEW ACADEMY UPDATE



THE ACADEMY'S NEW BUILDING out in Golden Gate Park has often been compared to a living organism. A central computer system automatically opens and closes windows and skylights, allowing the building to "breathe" for itself. A complex network of veins comprised of more than seven miles of piping delivers fresh and salt water to the aquarium's tanks. And up on the rolling roof, more than 1.7 million native plants form an insulating pelt that protects the building from both heat gain and heat loss.

Now, in addition to functioning as a living organism, the building is home to living organisms as well. The first live corals have been planted in the Philippine Coral Reef tank, and the tank's first fish are now exploring their new habitat. Academy biologists have completed their inaugural dives in the tank and report that the reef is shaping up to be a beauty. The Rainforests of the World exhibit is also coming to life, as the bright green leaves of a mahogany tree, a Brazilian beautyleaf, two peach palms, and several other species begin to fill the dome. Over the next few months, both exhibits will receive more residents, including sharks, rays, and sea turtles for the coral reef lagoon.

Work is also well underway on African Hall. The original diorama animals have all been cleaned and brushed using a process similar to dry cleaning. The background murals have been meticulously recreated to match the color palettes and brush stroke patterns of the originals. Diorama installation is scheduled to begin later this month. Once complete, the new African Hall will look almost identical to the original—with just a few small changes. The Academy's colony of African penguins will now splash and swim at the end of the hall, and African reptiles and fish will bring new life to some of the smaller dioramas. Plasma touch-screens will also offer visitors the chance to take a virtual safari and dive deeper into the animals' habitats.

Over at the California Coast tank, rockwork specialists are busy attaching barnacles and mussels to the tank's rocky habitat, and final adjustments are being made to the wave machine. Soon, the tank will be filled with water and will undergo a pH-balancing treatment. Later this spring, the empty exhibit will be transformed into a kelp forest brimming with fish, sea stars, and other organisms that are native to the northern California coast.

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